REMARKS

The Examiner is thanked for the thorough examination of the above-referenced application. The FINAL Office Action mailed March 10, 2006, however, has continued to reject all pending claims. In response, claims 19, 27, 31, 34, and 42 have been amended. Accordingly, the rejections of these claims are rendered moot by the amendments. Applicant requests reconsideration of the outstanding rejections of all pending claims for at least the reasons that follow.

Independent Claim 19

As amended, independent claim 19 recites:

> 19. A metal structure, comprising:
> a semiconductor substrate with a conductor thereon;
> an insulating layer overlying the semiconductor substrate having a hole therein exposing the conductor, wherein the insulating layer comprises USG;
> a conductive plug substantially filling the hole and electrically connecting the underlying conductor, wherein the conductive plug comprises tungsten;
> ***a carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide, serving as an etching stop layer, on the insulating layer and the conductive plug;***
> a low dielectric constant layer overlying the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide;
> a trench in the low dielectric constant layer and the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide; and
> a copper or copper alloy conductor substantially filling the trench, electrically connecting the conductive plug.

(*Emphasis added.*) Claim 19 patently defines over the cited art for at least the reason that the cited art fails to disclose the features emphasized above.

Independent Claim 34

As amended, independent claim 34 recites:

> 34. A metal structure, comprising:
> a semiconductor substrate with a conductor comprising nickel silicide thereon;
> an insulating layer overlying the semiconductor substrate having a hole therein exposing the conductor, wherein the insulating layer comprises USG;
> a conductive plug substantially filling the hole and electrically connecting the underlying conductor, wherein the conductive plug comprises tungsten;
> ***a carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide, serving as an etching stop layer, on the insulating layer and the conductive plug;***
> a low dielectric constant layer overlying the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide;
> a trench in the low dielectric constant layer and the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide;
> a diffusion layer lining the trench; and
> a copper or copper alloy conductor substantially filling the trench, electrically connecting the conductive plug.

(*Emphasis added.*) Claim 34 patently defines over the cited art for at least the reason that the cited art fails to disclose the features emphasized above.

Independent Claim 42

As amended, independent claim 42 recites:

> 42. A metal structure, comprising:
> a semiconductor substrate with a conductor thereon;
> an insulating layer overlying the semiconductor substrate having a hole therein exposing the conductor, wherein the insulating layer comprises USG;
> a conductive plug substantially filling the hole and electrically connecting the underlying conductor, wherein the conductive plug comprises tungsten;
> ***a carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide, serving as an etching stop layer, on the insulating layer and the conductive plug;***
> a low dielectric constant layer overlying the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide;
> a trench in the low dielectric constant layer and the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide;

a diffusion layer lining the trench; and

a copper or copper alloy conductor substantially filling the trench, electrically connecting the conductive plug.

(*Emphasis added.*) Claim 42 patently defines over the cited art for at least the reason that the cited art fails to disclose the features emphasized above.

Rejections Under 35 U.S.C. 112

Claims 27 and 31 were rejected under 35 U.S.C. 112, second paragraph, as allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Claims 27 and 31 are amended herein to address and overcome this rejection.

Rejections Under 35 U.S.C. 102(e)

Claims 19, 20, 23-24, 27, 28-30, 33, and 42 were rejected under 35 U.S.C. 102(e) as allegedly anticipated by US 6,908,847 to *Saito et al.* In additional to distinctions set forth in previous responses (which Applicant incorporates by reference herein), Applicants requests reconsideration of the rejections for at least the following additional reasons.

Independent Claims 19 and 42

Applicant respectfully submits that Saito fails to disclose or suggest a method as recited in claims 19 and 42. Specifically, Saito clearly fails to disclose, ***"a carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide, serving as an etching stop layer, on the insulating layer and the conductive plug".*** At least the features/limitations described above are not taught or suggested by Saito. In this regard, Saito discloses that carbon doped oxide 501 is between

two IMD layers of low-k materials (i.e. M1 and CM1). Furthermore, TEOS film 24a directly contacts M1. In contrast, claims 19 and 42 recite that the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide are on the W plug, thereby enhancing the adhesion between the low-k IMD and regular-k ILD. Additionally, the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide directly contacts the W plug (based on the well-known and accepted definition of the term "on"). For at least these reasons, Applicant respectfully asserts that the independent claims 19 and 42 (as amended herein) are in condition in allowance. Since claims 20, 23-24, 27, 28-30, and 33 are dependent claims that incorporate the features/limitations of claim 19, these claims are also in condition in allowance.

Rejections Under 35 U.S.C. 103(a)

Claims 21, 25, 32, 34-41 were rejected under 35 U.S.C. 103(a) as allegedly unpatentable over US 6,908,847 to Saito et al. in view of US 6,838,363 to Wieczorek et al.

Independent Claim 34

Applicant respectfully submits that Saito and Wieczorek fail to properly disclose or suggest the method, as recited in claims 19, 34, or 42. In particular, these references fail to disclose or suggest the claimed feature of *"**a carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide, serving as an etching stop layer, on the insulating layer and the conductive plug**"*. Accordingly, Applicant respectfully submits that claim 34 is patentable over the combination of Saito in view of Wieczorek.

Specifically, as amended, claim 34 defines a combination of two independent single damascence structures (i.e. an ILD underlying the adhesion layer and an IMD over the adhesion

layer). The ILD comprises a regular-k insulating layer of USG, and the IMD comprises a low-k dielectric. The etching stop layer of a carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide is different from that made of TEOS disclosed by Saito. Moreover, the etching stop layer is defined to be on the insulating layer and the conductive plug of tungsten. That is, the etching stop layer directly contacts the insulating layer and the conductive plug (based on the well-known and accepted definition of the term "on"). For at least this reason, the rejection of claim 34 should be withdrawn.

In addition, under MPEP 2143, to establish a *prima facie* case of obviousness, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Since the cited references do not teach the above-quoted limitations of the amended claim 34, Applicant respectfully submits that this claim should be allowed. Claims 35-41 should also be allowed, at least by virtue of their dependency from the amended claim 34.

As a separate and independent basis for the patentability of the claims, Applicants respectfully traverse the rejections as failing to identify a proper basis for combining the cited references. In combining these references, the Office Action stated only that the combination of Wieczorek with Saito would have been obvious "because such metal silicide would have good junction and low sheet resistance as taught by Weiczorek." (Office Action, page 7). This alleged motivation is clearly improper in view of well-established Federal Circuit precedent.

It is well-settled law that in order to properly support an obviousness rejection under 35 U.S.C. § 103, there must have been some teaching in the prior art to suggest to one skilled in the art

that the claimed invention would have been obvious. W. L. Gore & Associates, Inc. v. Garlock Thomas, Inc., 721 F.2d 1540, 1551 (Fed. Cir. 1983). More significantly,

> "The consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this [invention] should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. ..." Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure... In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill in the art is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention."

(*Emphasis added.*) In re Dow Chemical Company, 837 F.2d 469, 473 (Fed. Cir. 1988).

In this regard, Applicant notes that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also requires the prior art to suggest both the combination of elements and the structure resulting from the combination. Stiftung v. Renishaw PLC, 945 Fed.2d 1173 (Fed. Cir. 1991). Therefore, in order to sustain an obviousness rejection based upon a combination of any two or more prior art references, the prior art must properly suggest the desirability of combining the particular elements to derive a Tungsten-Copper Interconnect, as claimed by the Applicant.

When an obviousness determination is based on multiple prior art references, there must be a showing of some "teaching, suggestion, or reason" to combine the references. Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1579, 42 USPQ2d 1378, 1383 (Fed. Cir. 1997) (also noting that the "absence of such a suggestion to combine is dispositive in an obviousness determination").

Evidence of a suggestion, teaching, or motivation to combine prior art references may flow, inter alia, from the references themselves, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. See In re Dembiczak, 175 F.3d 994, 1000, 50

USPQ2d 1614, 1617 (Fed. Cir. 1999). Although a reference need not expressly teach that the disclosure contained therein should be combined with another, the showing of combinability, in whatever form, must nevertheless be "clear and particular." Dembiczak, 175 F.3d at 999, 50 USPQ2d at 1617.

If there was no motivation or suggestion to combine selective teachings from multiple prior art references, one of ordinary skill in the art would not have viewed the present invention as obvious. See In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998); Gambro Lundia AB, 110 F.3d at 1579, 42 USPQ2d at 1383 ("The absence of such a suggestion to combine is dispositive in an obviousness determination.").

Significantly, where there is no apparent disadvantage present in a particular prior art reference, then generally there can be no motivation to combine the teaching of another reference with the particular prior art reference. Winner Int'l Royalty Corp. v. Wang, No 98-1553 (Fed. Cir. January 27, 2000).

For at least the additional reason that the Office Action failed to identify proper motivations or suggestions for combining the various references to properly support the rejections under 35 U.S.C. § 103, those rejections should be withdrawn.

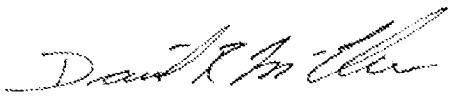
CONCLUSION

In light of the foregoing amendments and for at least the reasons set forth above, Applicant respectfully submits that all objections and/or rejections have been traversed, rendered moot, and/or accommodated, and that the now pending claims are in condition for allowance. Favorable reconsideration and allowance of the present application and all pending claims are hereby courteously requested.

If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (770) 933-9500.

A credit card authorization has been provided to cover the payment of the accompanying Extension of Time request and RCE filing. No additional fee is believed to be due in connection with this amendment and response to Office Action. If, however, any additional fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,



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